Selecting Functions Via A Graphical User Interface

Cross Reference to Related Applications

[0001]   This application claims the benefit under 35 U.S.C. § 119 of the

5   following co-pending and commonly-assigned patent application, which is

incorporated by reference herein:

[0002]   United Kingdom Patent Application Number 02 16 824.3, filed on July

19, 2003, by Chris Vienneau, Juan Pablo Di Lelle, and Michiel Schriever,

entitled "SELECTING FUNCTIONS VIA A GRAPHICAL USER INTERFACE".

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[0003]   This application is related to the following commonly-assigned United

States patents, which are incorporated by reference herein:

[0004]   United States Patent No 5,892,506, filed on March 18, 1996 and

issued on April 6, 1999, by David Hermanson, entitled "MULTIRACK

15   ARCHITECTURE FOR COMPUTER-BASED EDITING OF MULTIMEDIA

SEQUENCES", Attorney's Docket Number 30566.151-US-01;

[0005]   United States Patent No 5,786,824, filed on April 10, 1996 and issued

on July 28, 1998, by Benoit Sevigny, entitled "PROCESSING IMAGE DATA",

Attorney's Docket Number 30566.170-US-01; and

20   [0006]   United States Patent No 6,269,180, filed on April 9, 1997 and issued

on July 31, 2001, by Benoit Sevigny, entitled "METHOD AND APPARATUS

FOR COMPOSITING IMAGES", Attorney's Docket Number 30566.180-US-01;

Background of the Inv ntion

1. Field of the Invention

[0007] The present invention relates to apparatus for processing image data.

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2. Description of the Related Art

[0008] Systems for processing image data, having a processing unit, storage devices, a display device and a stylus-like manually operable input device (such as a stylus and touchtablet combination) are shown in United

10 States Patents 5,892,506; 5,786,824 and 6,269,180 all assigned to the present Assignee. In these aforesaid systems, it is possible to perform many functions upon stored image data in response to an operator manually selecting a function from a function menu.

15 [0009] Recently, in such systems as "FIRE" and "INFERNO", licensed by the present Assignee, the number of functions that may be performed have increased significantly. In addition, for example, there has been a tendency towards providing functions for special effects, compositing and editing on the same platform.

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[0010] Function selection is often done via graphical user interfaces in which menus are displayed from which a selection may be made. A function selection using a menu is achieved by moving a cursor over to a selection

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position within the menu by operation of the stylus. The particular function concerned is selected by placing the stylus into pressure; an operation logically similar to a mouse click. Menus of this type are used in systems where stylus-like input devices are preferred, in preference to pulldown

5   menus.

[0011]   In addition to there being a trend towards increasing the level of functionality provided by digital image processing systems, there has also been a trend towards manipulating images of higher definition. Initially, many

10   systems of this type were designed to manipulate standard broadcast television images such as NTSC or PAL. With images of this type, it is possible to display individual frames on a high definition monitor such that the displayed images take up a relatively small area of the monitor thereby leaving other areas of the monitor for displaying menus etc. Increasingly,

15   digital techniques are being used on high definition video images or images scanned from cinematographic film. Such images have a significantly higher pixel definition. Consequently, even when relatively large monitors are used, there may be very little additional area for the display of menus.

20   [0012]   Furthermore, operators and artists are under increasing pressure to speed up the rate at which work is finished. Being able to work with systems of this type quickly and efficiently is not facilitated if complex menu structures

are provided or manipulation tools are included that are not intuitive to the way artists work.

Brief Summary of the Invention

[0013]   According to a first aspect of the present invention, there is provided apparatus for processing image data, comprising processing means, storage means, display means and stylus-like manually operable input means, wherein said processing means is configured to perform functions upon image data in response to an operator manually selecting a function from a function menu; said processing means responds to a first user-generated input command so as to display a plurality of function gates at a cursor position; movement of the stylus-like manually operable input means so as to move said cursor through one of said function gates results in a related menu being displayed; and manual selection of a function from said displayed menu results in the selected function being performed upon said image data.

Brief Description of the Several Views of the Drawings

[0014]   *Figure 1* shows a system for processing image data;

[0015]   *Figure 2* shows details the computer system shown in *Figure 1*;

[0016]   *Figure 3* shows illustrates the display of the prior art;

[0017]   *Figure 4* shows the display of *Figure 3* with graphically displayed menus as is known in the prior art;

[0018] *Figure 5* shows an example of a scene graph defining how a complex scene is rendered;

[0019] *Figure 6* is the monitor of *Figure 1* displaying a high definition image;

[0020] *Figure 7* shows a portion of the image shown in *Figure 6* with user interface gates;

[0021] *Figure 8* shows an abstracted view of the gates shown in *Figure 7*;

[0022] *Figure 9* shows the high definition image of *Figure 6* with an overlaid upper menu;

[0023] *Figure 10* shows the high definition image of *Figure 6* with a lower menu;

[0024] *Figure 11* shows the high definition of *Figure 6* with a menu to the left;

[0025] *Figure 12* shows the high definition image of *Figure 6* with a menu to the right;

[0026] *Figure 13* identifies operations performed by the processing unit shown in *Figure 2*;

[0027] *Figure 14* details procedures identified in *Figure 13*;

[0028] *Figure 15* details procedures identified in *Figure 14*;

[0029] *Figure 16* details procedures identified in *Figure 15*;

[0030] *Figure 17* identifies a first alternative embodiment of the present invention;

[0031] *Figure 18* identifies further alternative embodiments of the present invention.

[0032] An embodiment of the invention will now be described by way of example only with reference to the above drawings.

Detailed Description

Figure 1

[0033] Apparatus for processing image data is illustrated in *Figure 1*. In this example a computer system **101** supplies output signals to a visual display unit **102**. The visual display unit **102** displays images, menus and a cursor, and movement of said cursor is controlled in response to manual operation of a stylus **103** upon a touch table **104**. In addition, input data is also supplied to the computer system **101** via a keyboard **105**. Keyboard **105** is of a standard alpha numeric layout and includes a spacebar **106**. Manual operation of the spacebar **106** provides a first input command in a preferred embodiment resulting in a selection device being displayed at the cursor position. The selection device identifies a plurality of function types (for example four) each having an associated displayable menu. In response to a second input command, preferably received from the stylus **103**, the cursor is moved over one of the identified function types. Thereafter, having moved the cursor over a displayed type, the aforesaid menu associated with the function type over which the cursor has been moved is displayed. In this way, a user is given rapid access to a menu of interest without said menu being continually displayed over the working area of the VDU **102**.

Figure 2

[0034]   Computer system **101** is illustrated in *Figure 2*. System bus **201**

provides communication between a central processing unit **202**, random

5   access storage devices **203**, a video card **204**, disk storage **205**, CD ROM

reader **206**, a network card **207**, a tablet interface card **208** and a keyboard

interface card **209**. Typically, the central processing unit may be an Intel

based processor operating under the Windows operating system. Program

instructions for the central processing unit **202** are read from the random

10   access memory device at **203**. Program instructions are preferably received

via a CD ROM **210** (or similar computer-readable medium) for installation

within the storage system of disk drive **205** via the CD ROM reader **206**.

[0035]   Network card **204** supplies output signals to monitor **102** with input

15   signals from the tablet **104** being received via a tablet interface **208** and input

signals from keyboard **105** being received via the keyboard interface **209**.

Network interface **207** allows the system to exchange files with a server or

other networked stations.

20   *Figure 3*

[0036]   A monitor **301**, of a prior art system and not that shown in *Figure 1*,

is illustrated in *Figure 3*. The monitor is displaying a video image **302**

consisting of a plurality of frames played over a period of time at standard

broadcast definition. The monitor has a substantially higher definition, thereby

ensuring that there is plenty of space around the image **302** for graphical

interfaces to be displayed. The skilled reader will understand that it is the

entire system that is prior art and not specifically the high-definition monitor. A

5   similar monitor could be used in an embodiment of the present invention.

Figure 4

[0037]   Monitor **301** is shown in *Figure 4* with a plurality of menus, such as

menu **304** and menu **305**, displayed around video image **302**. In this way,

10   many control functions may be selected by appropriate operation of a stylus

upon a touch-tablet. A function of interest is selected by placing the cursor

over a soft button. The button is then depressed by placing the stylus into

pressure. This may result in a function being performed upon the image

directly or, alternatively, may result in an appropriate sub-menu being

15   displayed so that appropriate control may be made in response to user input.

[0038]   It can be appreciated that the working space displayed on monitor

301 has become somewhat complex if all available functions are to be

displayed.

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Figure 5

[0039]   The number of possible functions available to an artist has

increased and there is a trend for more and more of these functions to be

used concurrently to produce a particular effect. Furthermore, it is preferable for the nature of the functions to be stored as definitions or metadata whereafter their implementation takes place in real-time. Thus, the process of compositing etc requires many functions to be performed as part of a final rendering operation rather than partially processed work being stored and then processed again. Consequently, many functions may be required and in order to make modifications an artist is required to identify a particular function of interest.

[0040]   In order to provide artists with a representation of the nature of a function being performed, the structure of the processing operations may be displayed as a process tree, as illustrated in *Figure 5*. Process trees generally consist of sequentially linked processing nodes, each of which specifies a particular processing task required in order to eventually achieve an output in the form of a composited frame or video sequence. Traditionally, an output sequence **501** will comprise both image data and audio data. Accordingly, the composited scene will require the output from an image keying node **502** and the output from a sound mixing node **503**. In this example, the image keying node **502** calls on a plurality of further processing nodes to obtain all the input data it requires to generate the desired image data, or sequence of composited frames. In the example, the desired output image data includes a plurality of frames within which a three-dimensional computer generated

object is composited, as well as a background also consisting of a plurality of three-dimensional objects superimposed over a background texture.

[0041] The image keying node **502** requires a sequence of frames originating from node **504**. Each frame undergoes a colour correction process at node **505** followed by a motion tracking process at a motion tracking process node **506**. Modelled 3D objects are generated by a three-dimensional modelling node **507** and a texture is applied to these objects by a texturing node **508**. After being textured, lighting is applied by an artificial light processing node **509**, followed by a scaling operation performed by a scaling node **510**. Tracking node **506** is then responsible for combining the computer generated object with the image frames. To generate the background, image processing node **502** also requires a uniform texture from a texturing node **511**. Colour correction is applied to this texture by means of colour correction node **512** a further three-dimensional modelling node **513** generates further objects upon which lighting is applied by node **514** followed by tracking performed by node **515**. Consequently, image keying node **502** may now composite the foreground objects with the background.

[0042] Each node illustrated in *Figure 5* will have an associated menu of controls allowing modifications to be made at that particular point in the overall image processing exercise. Thus, when modifications are made at the menu level, it is necessary for a database to be established so as to oversee

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the relationship between manual input commands being made and their associated node at which the modifications are to take effect. Thus, the complexity of images results in a greater requirement for the display of control menus so as to allow full control to be given to an artist during a compositing exercise. It will be appreciated that other methods of storing data associated with processing operations exist, and that the invention is not limited to image processing apparatus which operates in the way described herein.

Figure 6

[0043] Problems associated with the availability of free monitor space are made worse when the definition of images being processed is increased. *Figure 3* shows a prior art example of a standard television broadcast image being processed. However, as illustrated in *Figure 6*, the present invention is particularly directed towards the processing of higher definition images such as images derived from cinematographic film. Thus, a high definition image has been loaded of a definition such that, when displayed, as illustrated in *Figure 6*, the whole of the available display space of visual display unit **102** is used for displaying the image frames. Even with very large visual display units, it is recognised that artists must work with material at an appropriate definition so as to ensure that the introduction of visible artefacts is minimised. However, a problem with displaying images at this definition, as

illustrated in *Figure 6*, is that the monitor does not provide additional space for the display of menus alongside the displayed high definition images.

[0044] Region **602** of the high definition image **601** is shown enlarged in *Figure 7*. A cursor **603** is shown in *Figure 6* at a selected position. After being placed in this selected position, an artist operates spacebar **106** of the keyboard **105** resulting in a selection device being displayed at the cursor **603** position. Clearly other ways of activating the selection device may be used apart from the space bar, for example other keys on the keyboard, a button on the stylus, and so on.

Figure 7

[0045] A displayed selection device providing four selection regions, that have been identified as "gates", is shown at **701** in *Figure 7*. Each gate of the displayed device **701** identifies a function type and each of said function types has an associated displayable menu. After activating the spacebar, the selection device **701** is located around the position of the displayed cursor **603**. The selection device **701** remains displayed after the space bar has been activated. A further activation of the space bar removes the device **701**. In addition, device **701** is also removed if the stylus is activated so as to move the cursor **603** through one of the gates **702** to **705**. Moving the stylus **103** in an upwards direction results in the displayed cursor **603** passing through the "viewer" gate **702**. In response to passing the cursor **603** through the viewer

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gate **702**, a viewer menu is displayed in an upper portion of the screen.

Similarly, by moving the stylus **103** in a downward direction, the cursor **603** is

passed through a tool control gate **703** (a transform in this example),

identified as a transform tool in *Figure 7*. By moving the stylus **103** to the left,

5   the cursor **603** passes through a "layer" gate **704** resulting in an associated

menu being displayed to the left of the image. Furthermore, by moving the

stylus **103** to the right, the displayed cursor **603** is taken through the tools

gate **705**, resulting in an appropriate menu being displayed to the right of the

image.

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[0046]   The particular function types available are relevant to the application

being performed in the preferred embodiment. However, it should be

appreciated that similar techniques may be used in different environments.

Within the same application, it is possible that different views may be called

15   and one or more of said views may have an interface device relevant to that

particular view. For example, a schematic view may be shown or a player

view may be shown. Upon calling the interface device (by activation of the

space bar) the interface device may be relevant to schematic operations

when the schematic view is shown and may be relevant to player operations

20   when the player view is shown. The schematic viewer displays the entire

composition (that is to say the whole graph). The user usually has a node

selected in the graph. When the user displays the schematic gate device it

will preferably display the schematic starting from the current selection. This

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will show the user everything in the scene that generated the current selection and is therefore a filtered version of the schematic view.

Figure 8

[0047] An abstracted interface is illustrated in *Figure 8*. In response to a first input command, an interface device **801** is displayed at a cursor **806** position. In this embodiment, this first input command consists of the spacebar of a keyboard being depressed. The interface device identifies a plurality of function types (**802**, **803**, **804**, **805**) and by passing a cursor **806** through one of these function types, an appropriate menu is displayed Although the menu can be displayed in any part of the screen, it is preferably displayed at a location related to the gate through which the cursor has passed. Thus, if the cursor **806** moves to the left, preferably a left menu is displayed; if the cursor **806** moves to the right, preferably a right menu is displayed; if the cursor **806** moves upwards, preferably an upper menu is displayed; and if the cursor **806** moves downwards, preferably a lower menu is displayed.

Figure 9

[0048] In a preferred embodiment, movement of cursor **602** in response to stylus **103** in an upwards direction through gate **702** results in a movement of viewer gate menu **901** being displayed in an upper portion of the screen. The viewer gate menu is used to set viewer specific options such as render pre-

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sets for three-dimensional players or filtering for schematics. The viewer

menu relates directly to the viewer in focus and the name of the viewer in

focus preferably appears in the gate user interface. The displayed menu

takes up the same width as a tool panel user interface and it is locked to the

5   top of the user interface regardless of how many viewers are present. The

panel is fully opaque and sits over all other panels. Upon leaving the viewer

menu the menu itself disappears thereby returning the full screen to the

image under consideration.

10   *Figure 10*

[0049]   Moving the cursor **602** in a downward direction, through gate **703**,

results in a current tool menu **1001** (a transform in this example) being

displayed in a lower region of the screen of monitor **102**. The current tool

menu is used to interact with the current tool. Gate **703** is only available if one

15   tool has been selected. Thus, the gate relates directly to the current tool

under consideration. The name of the current tool preferably appears in the

gate user interface. The menu is locked to the bottom of the player in focus

and use is also made of the transport tool user interface.

20   [0050]   After use has been made of the current tool menu, the menu is

removed by activating spacebar **106** again, thereby making the whole screen

available for the whole image. Activation of an "escape" has a similar effect.

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Figure 11

[0051]   Upon moving cursor **602** in a leftward direction through gate **704**, a layer gate menu **1101** is displayed. The layer menu is used to select layers and the layer user interface takes up the same width as a layer list. It is

5   locked to the left side of the user interface regardless of how many viewers are present. The panel is fully opaque and sits over all other panels. The layer gate menu **1101** only contains details of the layers; the layer list is not expandable and there is no value column. A user can set whether a layer is visible or not visible and the layer menu **1101** disappears after the cursor

10   exits to a new area.

Figure 12

[0052]   Upon moving cursor **602** in a rightwards direction through gate **705** tools menu **1201** is displayed. The tools menu is used to select the current

15   tool and is only available when only one layer has been selected. The tools gate menu takes up the same width as the layer list and is locked to the right side of the interface regardless of how many viewers are present. The panel is fully opaque and sits over all other panels. The tools menu **1201** contains a filtered version of the schematic showing only the tools associated with a

20   selected object. The menu disappears after the cursor has been moved out of the menu area. It should be appreciated that these particular menu selections are purely an application of the preferred embodiment and many

alternative configurations could be adopted while invoking the inventive concept.

Figure 13

5   **[0053]**   Operations performed by the processing unit **202** in order to provide the functionality described with reference to *Figures 6* to *12* is identified in *Figure 13*. After power-up an operating system is loaded at step **1301** whereafter at step **1302** the system responds to instructions from a user to run the compositing application.

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[0054]   At step **1303** data files are loaded and at step **1304** the application operates in response to commands received from a user. At step **1305** newly created data is stored and at step **1306** a question is asked as to whether another job is to be processed. When answered in the affirmative, control is
15   returned to step **1303** allowing new data files to be loaded. Alternatively, if the question asked at step **1306** is answered in the negative, the system is shut down.

Figure 14

20   **[0055]**   Procedures **1304** relevant to the present preferred embodiment are illustrated in *Figure 14*. At step **1401** a keyboard operation is captured and at step **1402** a question is asked as to whether the spacebar has been

activated. If answered in the negative, control is returned to step **1401** else control is directed to step **1403**.

[0056] In response to the spacebar being activated and detected at step **1402**, selection gates **701** are displayed at step **1403**. At step **1404** a question is asked as to whether the spacebar has been released and if answered in the affirmative, the selection gates are removed. Alternatively, if the question asked at step **1401** is answered in the negative, control is directed to step **1406** such that the application responds to further cursor movement.

Figure 15

[0057] Procedure **1406** is detailed in *Figure 15*. At step **1501** cursor movement is captured and at step **1502** a question is asked as to whether the cursor has moved across the upper gate **702**. If answered in the negative, control is directed to step **1505**, but if answered in the affirmative the upper menu (the viewer menu in the preferred embodiment) is displayed at step **1503** and the system responds to menu selections made at step **1504**.

[0058] At step **1504** a question is asked as to whether the cursor has crossed the lower gate **703** and if answered in the negative control is directed to step **1508**. If answered in the affirmative, to the effect that the cursor did cross the lower gate **703**, the lower gate menu (selected tool menu in the

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preferred embodiment) is displayed at step **1506** and responses to selections

are made at step **1507**.

[0059] At step **1508** a question is asked as to whether the cursor has

crossed the left gate **704** and if answered in the negative control is directed to

step **705**. In answered in the affirmative, the left gate menu (the layer menu in

the preferred embodiment) is displayed at step **1509** and responses to

selections are made at step **1510**.

[0060] At step **1511** a question is asked as to whether a cursor has crossed

the right gate **705**. If answered in the affirmative, the right gate menu (the

tools menu in the preferred embodiment) is displayed at step **1512** and the

system responds to manual selections at step **1513**.

Figure 16

[0061] Procedures **1504** for responding to input selections are detailed in

Figure 16. At step **1601** a position is captured when the stylus **103** is placed

in pressure.

[0062] At step **1602** a question is asked as to whether a menu has been

closed, either as a result of a "close menu" button being operated or, for

certain menus, whether the stylus has been taken outside the menu area. If

answered in the affirmative, the menu is closed at step **1603**.

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[0063] If the question asked at step **1602** is answered in the negative, a question is asked at step **1604** as to whether a function has been selected. If answered in the affirmative, the function is called at step **1605**.

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[0064] Procedures **1507, 1510** and **1513** are substantially similar to procedures **1504** shown in *Figure 16*.

Figure 17

10   **[0065]** An alternative embodiment is illustrated in *Figure 17*. Instead of the substantially circular device being divided into four sections, allowing four function menus to be selected, a circular device **1701** is divided into three sections from which three function devices may be selected.

15   *Figure 18*

[0066] A further alternative embodiment is illustrated in *Figure 18* in which a substantially circular device **1801** has been divided into six sections allowing six functional menus to be selected. In the preferred embodiments disclosed herein, the selection device has a substantially circular shape. It should also

20   be appreciated that other shapes, such as quadrilaterals etc may be adopted as an alternative.